



Department of Transportation
Federal Aviation Administration
Aircraft Certification Service
Washington, D.C.

TSO-C172a

Effective
Date: {mm/dd/yy}

Technical Standard Order

Subject: Cargo Restraint Strap Assemblies

1. PURPOSE. This technical standard order (TSO) is for manufacturers applying for a TSO authorization (TSOA) or letter of design approval (LODA). In it, we (the Federal Aviation Administration, (FAA)) tell you what minimum performance standards (MPS) your cargo restraint strap assemblies must first meet for approval and identification with the applicable TSO marking.

2. APPLICABILITY. This TSO affects new applications submitted after its effective date.

a. TSO-C172 will also remain effective until *{insert calendar date 18 months after publication date}*. After this date, we will no longer accept applications for TSO-C172.

b. Cargo restraint strap assemblies approved under a previous TSOA may still be manufactured under the provisions of its original approval.

3. REQUIREMENTS. New models of cargo restraint strap assemblies identified and manufactured on or after the effective date of this TSO must meet the MPS qualification and documentation requirements in SAE International (SAE) Aerospace Standard (AS) 5385C, *Cargo Restraint Straps – Design Criteria and Testing Methods*, dated January 2007, as modified by Appendix 1 of this TSO.

a. Functionality. This TSO's standards apply to equipment intended to be used to restrain cargo on board civil transport aircraft during flight.

b. Functional Qualification. Demonstrate the required performance under the test conditions in SAE AS5385C as modified by Appendix 1 of this TSO.

c. Environmental Qualification.

(1) Consider environmental degradation due to aging, ultra-violet (UV) exposure, weathering, etc., for any materials used in the construction of cargo restraint strap assemblies.

(2) For textile performance see SAE Aerospace Information Report (AIR) 1490B, *Environmental Degradation of Textiles*, dated December 2007, for available data when exposed to environmental factors. This data will be taken into account for consideration of the environmental effects of degradation on cargo restraint strap assemblies commensurate with the expected storage and service life.

NOTE: Environmental degradation data other than that documented in AIR1490B may be used if you substantiate the data and it is approved by the FAA aircraft certification office (ACO) manager responsible for administering your TSO or LODA. A cargo restraint strap assembly must meet the minimum performance requirements of this TSO at any time during its service life.

d. Deviations. We have provisions for using alternate or equivalent means of compliance to the criteria in the MPS of this TSO. If you invoke these provisions, you must show that your equipment maintains an equivalent level of safety. Apply for a deviation under the provisions of Title 14 of the Code of Federal Regulations (14 CFR) 21.618.

4. MARKING.

a. Mark at least one major component permanently and legibly with all the information in 14 CFR § 45.15(b).

b. Also, mark the following permanently and legibly, with at least the manufacturer's name, subassembly part number, and the TSO number:

(1) Each component that is easily removable (without hand tools); and,

(2) Each subassembly of the article that you determined may be interchangeable.

c. Mark each cargo restraint strap assembly permanently and legibly in accordance with SAE AS5385C, Section 7.3.

d. Mark the expiration date in the format "EXP YYYY-MM":

- (1) Mark the expiration date of a cargo restraint strap assembly as a limitation.
- (2) Mark each component or subassembly, as described in paragraph **4.b.** with its expiration date.
- e. Mark the rated ultimate load in decanewton (daN) and pound force (lbf) on each strap assembly.
- f. You may mark each cargo restraint strap assembly with any extra information listed in SAE AS5385C, Section 7, not specifically required in this paragraph.
- g. If the article includes a deviation per paragraph **3.e** of this TSO, marking must indicate a deviation was granted.

5. APPLICATION DATA REQUIREMENTS. You must give the FAA aircraft certification office (ACO) manager responsible for your facility a statement of conformance, as specified in 14 CFR § 21.603(a)(1) and one copy each of the following technical data to support your design and production approval. LODA applicants must submit the same data (excluding paragraph **5.e**) through their civil aviation authority.

- a. A Manual(s) containing the following:
 - (1) Operating instructions and article limitations sufficient to describe the equipment's operational capability.
 - (2) Describe in detail any deviations.
 - (3) Installation procedures and limitations sufficient to ensure that the cargo restraint strap assembly, when installed according to the installation or operational procedures, still meets this TSO's requirements. Limitations must identify any unique aspects of the installation. The limitations must include a note with the following statement:

“This article meets the minimum performance and quality control standards required by a technical standard order (TSO). Installation of this article requires separate approval.”
 - (4) Storage instructions.
 - (5) List of replaceable components, by part number, that makes up the cargo restraint strap assembly. Include vendor part number cross-references, when applicable.
- b. Instructions covering periodic maintenance, calibration, and repair to ensure that cargo restraint strap assemblies continue to meet the TSO approved design. Include recommended inspection intervals and service life, as appropriate.

c. A drawing depicting how the article will be marked with the information required by paragraph **4** of this TSO.

d. Identify functionality or performance contained in the article not evaluated under paragraph **3** of this TSO (that is, non-TSO functions). Non-TSO functions are accepted in parallel with the TSO authorization. For those non-TSO functions to be accepted, you must declare these functions and include the following information with your TSO application:

(1) Description of the non-TSO function(s), such as performance specifications, failure condition classifications, software, hardware, and environmental qualification levels. Include a statement confirming that the non-TSO function(s) do not interfere with the article's compliance with the requirements of paragraph **3**.

(2) Installation procedures and limitations sufficient to ensure that the non-TSO function(s) meets the declared functions and performance specification(s) described in paragraph **5.d.(1)**.

(3) Instructions for continued performance applicable to the non-TSO function(s) described in paragraph **5.d.(1)**.

(4) Interface requirements and applicable installation test procedures to ensure non-TSO function(s) compliance with the performance data defined in paragraph **5.d.(1)**.

(5) Test plans, analysis and results, as appropriate, to verify that performance of the hosting TSO article is not affected by the non-TSO function(s).

(6) Test plans, analysis and results, as appropriate, to verify the function and performance of the non-TSO function(s) as described in paragraph **5.d.(1)**.

e. The quality manual required by 14 CFR § 21.608, including functional test specifications. The quality system must ensure that you will detect any change to the approved design that could adversely affect compliance with the TSO MPS, and reject the article accordingly. (Not required for LODA applicants.)

f. Material and process specifications list.

g. List of all drawings and processes (including revision level) that define the article's design.

h. Manufacturer's TSO qualification report showing results of testing accomplished according to paragraph **3.b** of this TSO.

6. MANUFACTURER DATA REQUIREMENTS. Besides the data given directly to the responsible ACO, have the following technical data available for review by the responsible ACO:

- a. Functional qualification specifications for qualifying each production article to ensure compliance with this TSO.
- b. Article calibration procedures.
- c. Material and process specifications.
- d. The results of the environmental qualification tests conducted according to paragraph **3.c** of this TSO.
- e. If the article contains non-TSO function(s), you must also make available items **6.a** through **6.d** as they pertain to the non-TSO function(s).

7. FURNISHED DATA REQUIREMENTS.

a. If furnishing one or more articles manufactured under this TSO to one entity (such as an operator or repair station), provide one copy or on-line access to the data in paragraphs **5.a** and **5.b** of this TSO. Add any other data needed for the proper installation, certification, use, or for continued compliance with the TSO, of the cargo restraint strap assembly.

b. If the article contains declared non-TSO function(s), include one copy of the data in paragraphs **5.d.(1)** through **5.d.(4)**.

8. HOW TO GET REFERENCED DOCUMENTS

a. Order SAE documents from SAE International, 400 Commonwealth Drive, Warrendale, PA 15096-0001. Telephone (724) 776-4970, fax (724) 776-0790. You can also order copies online at www.sae.org.

b. Order copies of 14 CFR parts 21 and 45 from the Superintendent of Documents, Government Printing Office, P.O. Box 979050, St. Louis, MO 63197. Telephone (202) 512-1800, fax (202) 512-2250. You can also order copies online at www.gpo.gov.

c. You can find a current list of technical standard orders and advisory circulars on the FAA Internet website Regulatory and Guidance Library at <http://rgl.faa.gov/>. You will also find the TSO Index of Articles at the same site.

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APPENDIX 1. MINIMUM PERFORMANCE STANDARD FOR CARGO RESTRAINT STRAP ASSEMBLIES

This appendix prescribes the MPS for cargo restraint strap assemblies. The applicable standard is SAE AS5385C, *Cargo Restraint Straps – Design Criteria and Testing Methods*, dated January 2007.

Note: TSO-C172 Revision A specifically prohibits the use of the D6 end fitting defined in Section 3.6 (Figure 1) of SAE AS5385 Revision C due to risk of self or inadvertent disengagement whether or not under tension.

We modified it as follows:

<i>When reading AS5385C...</i>	<i>Do the following:</i>
Section 1	Disregard.
Section 2	Modify Paragraph 2., REFERENCES, by disregarding the last sentence.
Section 3	Modify 3.6 to omit reference to D6 in the first sentence. Modify Figure 1. to disregard D6 end fitting. Disregard 3.14. Disregard 3.15.
Section 4	Modify 4.4 to read as follows: The webbing, as used in the restraint strap assembly, i.e., including sewing and any treatment, shall meet the flammability test criteria of 14 CFR/EASA CS Part 25 Appendix F, Part I, paragraph (a)(1)(iv) , as amended by Amendment 25-32: it may not have a burn rate greater than 63.5 mm (2.5 in) per minute when tested horizontally with the apparatus and test procedures required in Appendix F, Part I, paragraph (b)(5) (see 5.8). Disregard 4.5.4 and 4.9.1. Modify 4.5.1 by adding the following note: “NOTE: Environmental degradation data other than that documented in AIR1490B may be used if you substantiate the data and it’s approved by the FAA ACO manager responsible for administering your TSO authorization or letter of design approval.” Disregard 4.5.2.

Section 5	Modify 5.3 by replacing “production” with “qualification”. Modify 5.1 by adding the following note: “NOTE: Equivalent alternate methods must be approved by the FAA ACO manager responsible for administering your TSO authorization or letter of design approval.” Disregard 5.9, 5.10, and 5.11
Section 6	Disregard
Section 7	Apply per Paragraph. 4, this TSO
Section 8	Disregard
Section 9	Disregard
Section 10	Disregard

